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UNITED STATES
ATOMIC ENERGY COMMISSION
Washington 25, D. C.

FOR RELEASE AT 4:00 P.M. (E.S.T.)
TUESDAY, FEBRUARY 15, 1955

STATEMENT
BY
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At a news conference on December 17, 1954, I stated that the staff of the Atomic Energy Commission was studying the subject of fallout and expressed the hope that information about it would be made public at a later date. "Fallout" is the word now applied to a phenomenon that follows the explosion of a nuclear weapon. Such an explosion, if the fireball touches the surface of the earth, draws up large amounts of materials into the bomb cloud. These materials subsequently fall back to earth as radioactive particles over a large area, mostly down-wind and relatively close to the point of explosion - although the lighter particles are carried great distances. The main radioactivity of fallout decreases very rapidly with time - for the most part, within the first hours after the explosion. An in-the-air explosion where the fireball does not touch the earth's surface does not produce any serious radiological fallout hazard.

Since nuclear weapons are in possession of the USSR, the Commission believes the American people wish to be informed regarding the dangers of nuclear explosions and the measures which individuals can take to protect themselves if an atomic attack should ever occur. Therefore, the Commission has condensed in the attached Report the information which can be made public at this time on the effects of the explosions of high-yield nuclear weapons.

The following excerpts and summarized sections contain the highlights of the Report itself.

FALLOUT PATTERN OF 1954 TEST IN THE PACIFIC

The very large thermonuclear device tested at Bikini Atoll on March 1, 1954, was detonated on a coral island and

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the ensuing fallout contaminated an elongated, cigar-shaped area extending approximately 220 statute miles down-wind and varying in width up to 40 miles. In addition, there was a contaminated area up-wind and cross-wind extending possibly 20 miles from the point of detonation. Data was collected from 25 points on 5 atolls located from 10 to 330 miles down-wind (generally east) from Bikini Atoll. Due to an unexpected shift in the direction of the prevailing winds in the higher altitudes, the fallout missed the observation rafts that had been placed farther north previous to the test firing. The estimated contour of the pattern of fallout is, therefore, based only in part on data obtained from actual measurements and partly on calculations.

Data from this and other tests permits estimates of casualties which would have been suffered within this contaminated area if it had been populated. These estimates assume: (1) that the people in the area would ignore even the most elementary precautions; (2) that they would not take shelter but would remain out of doors completely exposed for about 36 hours; and (3) that in consequence they would receive the maximum exposure. Therefore, it will be recognized that the estimates which follow are what might be termed extreme estimates since they assume the worst possible conditions.

On the basis of our data from this test and other information, it is estimated that, following the March 1, 1954, test explosion, there was sufficient radioactivity in a down-wind belt about 140 miles in length and of varying width up to 20 miles to have seriously threatened the lives of nearly all persons in the area who took no protective measures.

Some distance farther from the point of detonation, at about 160 miles down-wind and along the axis of the ellipse, the amount of radioactivity would have seriously threatened the lives of about one-half of the persons in the area who took no protective measures.

Near the outer edge of the ellipse, or approximately 190 miles down-wind, it is estimated that the level of radioactivity would have been sufficient to have seriously threatened the lives of 5 to 10 percent of any persons who might have remained exposed out of doors for all of the first 36 hours.

Thus, about 7,000 square miles of territory down-wind from the point of burst was so contaminated that survival

might have depended upon prompt evacuation of the area or upon taking shelter and other protective measures.

At a distance of 220 miles or more down-wind, it is unlikely that any deaths would have occurred from radioactivity even if persons there had remained exposed up to 48 hours and had taken no safety measures.

The estimates cited above do not apply uniformly throughout the contaminated area inasmuch as the intensity of radioactivity within a region of heavy fallout will vary from point to point, due to such factors as air currents, rain, snow, and other atmospheric conditions. Because of this and because most persons, if given sufficient warning, probably would evacuate the area or take shelter and other precautionary measures, the actual percentage of fatalities could reasonably be presumed to be considerably smaller than these extreme estimates.

PROTECTION AGAINST FALLOUT

In an area of heavy fallout the greatest radiological hazard is that of exposure to external radiation, which can be greatly reduced by simple precautionary measures. Exposure can be reduced by taking shelter and by simple decontamination measures. Test data indicates that the radiation level, i.e., the rate of exposure, indoors on the first floor of an ordinary frame house in a fallout area would be about one-half the level out of doors. Even greater protection would be afforded by a brick or stone house. Taking shelter in the basement of an average residence would reduce the radiation level to about one-tenth that experienced out of doors. Shelter in an old-fashioned cyclone cellar, with a covering of earth three feet thick, would reduce the radiation level to about 1/5000, or down to a level completely safe, in even the most heavily contaminated area. Designs of shelters of simple yet effective construction have been prepared by the Civil Defense Administration and are available to the public.

Radioactive material deposited during the fallout may or may not be visible but would be revealed by radiation detection instruments such as Geiger counters. Any falling dust or ash that can be seen down-wind within a few hours after a nuclear explosion should be regarded as radioactive until measured by a radiation detection instrument.

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Care should be taken to avoid the use of solid foods or liquids that may contain fallout particles.

If fallout particles come into contact with the skin, hair, or clothing, prompt decontamination precautions such as have been outlined by the Federal Civil Defense Administration will greatly reduce the danger. These include such simple measures as thorough bathing of exposed parts of the body and a change of clothing.

INTERNAL RADIATION EFFECTS

Two other factors must be considered in evaluating possible hazards from radioactive fallout. The first is the effect of internal radiation from fallout particles swallowed in food or liquids. The second is the effect of radiation upon the germ cells which transmit inherited characteristics from one generation to another. It should be noted that in neither case is there reason to believe that weapons testing programs of the United States have resulted in any serious public hazard.

The radioactive forms of strontium and iodine are the constituents of fallout which are of principal concern as internal sources of radiation through ingestion. The concentrations of these substances from nuclear detonations to date have been monitored at many localities, and the amounts detected have been insignificant, compared to concentrations which would be hazardous.

GENETIC EFFECTS OF RADIATION

There is a wide range of admissible opinion as to the genetic effects which radiation might have upon future generations, and conclusive data is not available at present on which to base an incontrovertible forecast. However, it is important to recognize that the average amount of radiation exposure received by residents of the United States from all nuclear detonations to date has been about the same as the exposure received from one chest X-ray. The Commission's medical and biological advisers do not believe that this small amount of additional exposure is any basis for serious concern at this time.

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BLAST AND HEAT EFFECTS

Two important characteristics of any nuclear explosion, other than those from fallout, are the effects of blast and heat, which are of the same nature for a thermonuclear bomb as for the earlier and smaller atomic bombs. The intensity and area of the blast and heat effects increase in relation to the greater energy yield of the explosion. Much information on these two effects has already been published by the Atomic Energy Commission, but it might be recalled that an atomic bomb of the earliest type, equivalent to 20,000 tons of TNT, would produce blast and heat sufficient to destroy, or damage severely, buildings within a radius of more than one mile from the explosion point. The United States has developed fission bombs many times as powerful as the first atomic bombs, and hydrogen weapons in the ranges of millions of tons (megatons) of TNT equivalent.

PROTECTION AGAINST BLAST AND HEAT

The hazard from both burn and blast effects well outside the central target area would be reduced greatly by shelter. Clothing or almost any kind of shelter would reduce the danger of direct burns, although there might be danger of clothing and structures becoming ignited. Also, shelter would materially reduce the hazard of blast injury by affording protection against flying or falling debris. As is generally known, the shelter afforded by ordinary city buildings would not suffice within the central area surrounding the point of explosion of a large nuclear weapon. For this reason, the Federal Civil Defense Administration recommends evacuation of the central areas of target zones on early warning of approaching attack.

FALLOUT FROM NEVADA TESTS

Only relatively small nuclear test explosions are conducted at the Nevada Test Site, in contrast to the tests of high-yield thermonuclear devices at the Pacific Proving Grounds. In Nevada, as well as in the Pacific, all tests are planned for times when forecast weather conditions minimize the possibility of fallout hazard. High air bursts at the Nevada Test Site have produced no significant fallout; heavy fallout from near-surface explosions has extended only

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a few miles from the point of burst. The hazard has been successfully confined to the controlled area of the Test Site. The highest actual dose of radiation at an off-site community has been estimated to be less than one-third of the greatest amount of radiation which atomic energy workers are permitted to receive each year under the Atomic Energy Commission's conservative safety standards.

CONCLUSION

In the event of war involving the use of atomic weapons, the fallout from large nuclear bombs exploded on or near the surface of the earth would create serious hazard to civilian populations in large areas outside the target zones. The Atomic Energy Commission hopes that these dangers will never be experienced by mankind. However, until the possibility of an atomic attack against us is eliminated by a workable international plan for general disarmament, the study and evaluation of the effects of weapons which might be used against us and the improvement of our means of self-defense are a paramount duty of our Government.